DOCUMENT RESUME

ED 153 741 PS 009 907

AUTHOR Field, Tiffany Martini
TITLE Visual and Cardiac Responses to Animate and Inanimate Faces by Young Term and Preterm Infants.
PUB DATE Apr 78
NOTE 27p.; Paper presented at the Biennial Southeastern Conference on Human Development (5th, Atlanta, Georgia, April 27-29, 1978)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Arousal Patterns; *Attention; Heart Rate; *Infant Behavior; Infants; Information Processing; Interaction Process Analysis; Parent Child Relationship; *Premature Infants; Research; *Stimulus Behavior; *Visual Stimuli

ABSTRACT

This paper presents a study of the looking and looking away or gaze alternation behavior of both full term and preterm infants in the presence of varying degrees of facial animation. The faces used in the study included, in increasing order of animation, a Raggedy Ann doll's face, a moving and talking doll's face, a mother's less animated face during imitations of the infant's behavior, and a mother's more animated face during spontaneous face-to-face interactions. Subjects for the study were 18 term and 18 preterm 3-month-old infants. It was hypothesized that the infants would spend more time looking at the doll than at the mother, and more time looking at the less animated than at the more animated faces. Both of these hypotheses were confirmed. Using heart rate change as a measure of arousal, it was also found that the infants' heart rates were significantly elevated during the spontaneous mother's face situation and were significantly lower during the inactive doll's face situation. The greatest increase in heart rate and looking away behavior was found for the preterm infants during the spontaneous mother's face situation. Results were discussed in terms of an arousal modulation and information processing interpretation. (BD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED153741

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Visual and cardiac responses to animate and inanimate faces by young term and preterm infants

Tiffany Martini Field

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Tiffany Martini Field

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

PS 009907

Runninghead: Responses to faces

Abstract

Infants' looking and looking away behaviors as well as cardiac responses to mothers' spontaneous and imitative and to dolls' animated and still faces were recorded for 18 term and 18 preterm infants when they were 3 months-old. Infants spent less time looking at their mothers' than at the dolls' faces and their heart rate levels were elevated while looking at mothers' faces. These effects were most pronounced for the preterm infants whose inferior scores on the animated visual items of the Brazelton neonatal scale suggested a continuity in visual inattentiveness to animate stimuli. Both groups also looked at the inanimate more than the animated doll's face and evidenced lower heart rate levels during that situation. An arousal modulation and information processing interpretation was made for the looking away behavior and elevated heart rate during the more arousing mothers' face situations.

Visual and cardiac responses to animate and inanimate faces by young term and preterm infants

Longer visual fixations of inanimate than animate faces have been reported for very young infants (Brazelton, Koslowski & Main, 1974; Carpenter, 1974; Carpenter, Tecce, Stechler & Freedman, 1970; Field, 1978). One-to-four- month-old infants fixated an inanimate monkey's face (Brazelton et al, 1974), a manikin's face (Carpenter, 1974; Carpenter et al, 1970) and a raggedy ann doll's face (Field, 1978) for longer periods than their mothers' faces. One interpretation of these findings relates to the novelty of the inanimate faces used in the above studies. Although a mother's face is relatively novel, inasmuch as it changes from second-to-second, the absolute novelty of the inanimate faces is presumably greater. Thus, the infant may habituate the mother's more familiar face faster, explaining the shorter visual fixations. Another possibility is that the mother's quickly changing face may place greater demands on the infant's information processing and arousal modulation abilities causing the infant to look away more often from the ever changing animate face of his mother.

In support of the latter position, longer visual fixations of mothers' faces by 2-to-4-month-old-infants have been facilitated by requesting the mother to slow down, simplify or "infantize" her behaviors, thereby decreasing the arousal or information processing demands placed on the infant. Although mothers typically "infantize" their behaviors or become less adult-like during interactions with their infants (Stern, 1974; Trevarthen, 1974), infantized behavior has been further enhanced by slowing down the mother's behavior via a counting exercise (Tronick,

Adamson, Wise, Als & Brazelton, Note 1) or via the mother's imitation of her infant's behaviors (Field, 1977). During these experimental manipulations infants fixated their mothers' faces for longer periods than they did during spontaneous face-to-face interactions. However, the duration of these fixations still did not approximate the durations of fixations on an inanimate doll's face (Field, 1978). Together, these studies suggest that there is a continuum of visual fixations of faces with very young infants looking at inanimate faces for longer periods than less animated mothers' faces and less animated mothers' faces for longer periods than more animated mothers' faces.

An animate face contains more stimulus change and thus more information to be processed than an inanimate face. An animate face is a more arousing stimulus eliciting longer periods of looking away, possibly to modulate arousal (Ellsworth & Ludwig, 1972; Wada, 1961). Although most of these studies recorded only the fixations or looking periods, infant looking and looking away periods or gaze alternation behavior has been noted in the presence of both animate and inanimate faces (Brazelton et al, 1974; Field, 1978; Peery & Stern, 1977). Some have intimated that periods of looking away are "time-outs" to process the information received during the previous looking period and to modulate arousal levels (Brazelton et al, 1974; Ellsworth & Ludwig, 1972; Fischer, 1973; Peery & Stern, 1975; Wada, 1961). If animate faces contain more information to be processed and are more arousing, and if looking away serves information processing and arousal modulation functions, then periods of looking might be shorter and periods of looking away longer for more animate faces. In addition, if looking away serves an information processing and arousal modulation function, then, as information

processing and arousal modulation abilities become more developed, the infant might spend shorter periods of looking away from an animate face containing more stimulus information.

Suggestive evidence for parallels between developing information processing and arousal modulation abilities and longer fixations of animate faces can be found in longitudinal studies of term infants and comparisons between preterm and term infants. Both Carpenter (1974) for term infants and Masi (1978) for term and preterm infants report longer fixations of animate (mothers') faces as infants become older. Preterm infants do not differ from term infants in length of visual fixations of an inanimate schematic face (Miranda, 1970) or an inanimate raggedy ann doll's face during the first few months (Field, 1978). However, preterm infants show shorter fixations of an examiner's animate face at birth than do preterm infants (Field, 1977) and of a mother's animate face at 4 and 8 weeks (Masi, 1977) and at 3 months (Field, 1977). Since these same preterm infants received less optimal scores on visual orienting of an animate face than did term infants at birth on the Brazelton Neonatal Behavioral Assessment Scale (Brazelton, 1973), there may be suggestive evidence for some continuity between limited orienting and tracking of animate faces at birth and shorter fixations of animate faces at 3 months (Field, 1977).

The purpose of this study was to measure looking and looking away or gaze alternation behavior of both term and preterm infants in the presence of varying degrees of facial animation. In increasing order of animation the faces were: a familiar inanimate raggedy ann doll's face, a somewhat animated (moving and talking) raggedy ann doll's face, a mother's less animated face during imitations of her infant's behaviors

and a mother's more animated face during spontaneous face-to-face interactions. We hypothesized that periods of looking would decrease and periods of looking away would increase, or the ratios of infant looking/looking away would be lower for the mother's than the doll's face and for the animated versus the inanimate faces. To provide some assessment of physiological arousal associated with varying degrees of facial animation, heart rate was simultaneously recorded. We hypothesized that higher tonic heart rate levels would characterize the more arousing mother's animated face stimulus situation.

Method

Subjects

Thirty-six 3-month-old infants were assigned to groups according to whether they were term or preterm. The groups were 18 term infants (M=40 weeks gestation) and 18 preterm infants (M=32 weeks). Each group was balanced for sex. The preterm infants had received inferior scores on the Brazelton Neonatal Scale animate visual orientation items (orienting and tracking the tester's face). The preterm group was included to assess any effects of prematurity and/or inferior visual orienting scores at birth on 3-month looking behavior. To adjust for gestational age differences of the groups, the 3-month observation dates were figured from the infant's expected date of delivery based on the mother's last menstrual period. Mothers of the infants were white, middle-class, high-school educated and averaged 24 years of age, and most of the infants were later born.

Procedure

The infants' looking behaviors in the presence of the various faces were videotaped in a small laboratory furnished like a living room. The

infants were positioned in an upright infant seat on a table situated in a curtain alcove so that they were seated approximately 18 inches (46 cms.) from the face of their mother or that of a raggedy ann doll. The raggedy ann doll is a popular, commercially available stuffed doll 2 feet tall with an adult size face of rather prominent features (big black eyes, bright red nose and hair), considerable color and contour contrast. Most of the mothers reported that this raggedy ann or a similar raggedy andy doll was already owned and quite familiar to their infants. The raggedy ann doll was suspended in an immobile position for the inanimate doll situation. For the more animated raggedy ann doll situation the doll's head was automatically nodded in a vertical plane by an attached string. A tape recorded voice emanating from the direction of the raggedy ann doll slowly repeated, "Hi there baby, how are you?" The nodding and tape recorded speech of the raggedy ann doll occurred for 50% of the situation time, 4 seconds on, 4 seconds off. Since we were interested in looking behaviors as a function of degree of animation and type of face (mother or doll), we wanted to match the doll's and mother's face on the dimension of proportion of time active. The Field (1977) study suggested that imitative mothers spend approximately 50% of the interaction time being active, so the animate doll's time in activity was set at 50%. For the lesser animated mother's face situation, the mothers were requested to imitate their infants' behaviors. For the more animated mother's face situation or the spontaneous face-to-face situation, the mothers were requested to pretend they were at home playing with their infants. The four situations were counterbalanced to control for any order or state effects.

Three minutes for each of those situations were recorded for each

of the infants. Two cameras and a split screen generator enabled us to record the infant and mother behaviors simultaneously on videotape. The cameras were positioned 6 feet (1.8 m) away from the infant and mother at an angle such that they were in the periphery of the subjects' visual fields as well as partially hidden by surrounding curtains.

The videotapes were coded via event recorders by trained college seniors naive to the experimental design. Absolute durations were calculated for infant looking at the faces, defined as eyes and head aligned with that of the stimulus face. In addition, to assess the relative animation of the mothers during spontaneous and imitative situations to insure that, as Field (1977) had found, mothers were more animated and active during the spontaneous than the imitative situation, we also coded the videotapes for mothers' facial activity (smiling, grimacing, talking and laughing). Interobserver reliabilities were assessed periodically and averaged .87 for infant looking at the mother's face and .96 for the doll's face, and .84 for maternal behaviors during the mother's face situations.

Heart rate of both mothers and infants was simultaneously recorded via Narco telemetry, one electrode being placed high on the sternum and the other on the left lateral costal margin, and the transmitters were pocketed in a little cloth bag worn like a necklace. Heart rate was recorded for 5 seconds prior to the onset of the face situation (which was registered on the heartrate tapes by a stimulus spike) and for the duration of the 3-minute situation. Five seconds of pre-situation or resting heart rate and 180 seconds of situation heart rate were averaged separately for the analyses of the change in heart rate (bpm) from resting activity to face situation activity.

Results

Visual fixations

Repeated measures 2(group)X 2(sex)X 4 (face situation) analyses of variance were first performed for the total amounts of infant looking and for the durations of looking/looking away periods. These analyses and subsequent group comparisons revealed the following: 1. both term and preterm infants spent more time looking at the doll's faces than the mother's faces (situation effect F (3, 30) = 10.31, $p < .001$) with looking time increasing in the following order: mother's spontaneous face, mother's imitative face, moving-talking doll's face and still-silent doll's face. Subsequent comparisons suggested that the infants looked significantly less at the mother's spontaneous face than any of the other faces and significantly less at the animated doll's than the inanimate doll's face; 2. a group X face situation interaction effect ($F(3,30)=9.18$, $p < .001$) suggested that although the preterm infants' looking time did not differ from that of the term infants during the inanimate and animate doll's face situations or the imitative mother's face situation, the preterm infants spent less time looking at the spontaneous mother's face than did the term infants; 3. a group X sex X face situation interaction ($F(3,30)=4.63$, $p < .01$) and post hoc comparisons suggested that the preterm males spent less time looking at the spontaneous mother's face than did the other infants (see figure 1).

insert figure 1 about here

Data on sequences of looking/looking away (mean duration of looking and looking away for each looking/looking away or gaze alternation sequence) were subjected to a similar repeated measures analysis of variance, revealing the following: 1. a similar situation effect ($F(3,30)=7.39$, $p < .001$) suggested that the periods of looking were longer and periods

of looking away shorter in the presence of the doll's faces than the mother's faces (see figure 2). Ratios of mean duration of looking/looking away across gaze alternation periods were significantly lower for mother's spontaneous face than for other faces and for the still than the animated doll's face. 2. A group X face situation interaction ($F(3,30)=8.18$, $p < .001$) suggested that the ratio of looking/looking away for preterm infants was significantly lower than term infants during the spontaneous mother's face situation.

insert figure 2 about here

Tonic Heartrate

Repeated measures 2 (group) X 2 (sex) X 4 (face situation) analyses of variance were performed first on baseline heartrate (average of 5 seconds pre-situation heartrate). There were no reliable differences between the groups of infants or across situations for infant baseline heartrate (term M=156 bpm and preterm M=158 bpm).

A repeated measures analysis of variance was then performed on the beat-per-minute (bpm) change in heart rate activity from baseline (average of 5 pre-situation secons) to the face situation (average of 180 seconds heartrate during the face situations). This analysis revealed the following: 1. A main effect for situation ($F(3,30)=6.19$, $p < .005$) and subsequent comparisons suggested that tonic heart rate was significantly elevated over baseline for both term and preterm groups during the spontaneous mother's face situation, and significantly lower than baseline for both term and preterm groups during the still doll's face situation. Heart rate changes for the mother's imitative face and the animated doll's face situations were not reliable. 2. A group X face situation interaction ($F(3,30)=5.32$, $p < .01$) and post hoc comparisons suggested that the heart rate of the preterm infants was significantly more elevated than that of the term infants during the spontaneous mother's face situation. (see figure 3).

insert figure 3 about here

Mother's activity and heart rate levels

In order to ensure that we had correctly designated the mother's imitative face situation as being less animated than the mother's spontaneous face situation, we coded the videotapes for % of time the mothers were active (smiling, grimacing, talking or laughing). As an additional index of activity level we recorded heart rate, anticipating that more activity would be accompanied by higher heart rate levels.

A repeated measures analysis 2 (group) X 2 (sex) X 2 (face situation) with the mother's face situations (spontaneous and imitative) as the repeated measure yielded a main effect for situation ($F(1,32)=17.11$, $p < .001$) with mothers of both term and preterm infants being more active during the spontaneous (73% of time active) than the imitative situation (54% of time active). A group X situation effect ($F(1,32)=15.28$, $p < .001$) suggested that mothers of preterm infants were more active (82% of time active) during the spontaneous situation than were the mothers of term infants (64% of time active).

A repeated measures analysis of variance was then performed on baseline-situation heartrate change of the mothers (baseline M=78 bpm for mothers of term infants, baseline M=81 bpm for mothers of preterm infants, a non-significant difference). This analysis yielded only a group X situation interaction ($F(1,32)=7.91$, $p < .01$), suggesting that mothers of term infants showed a significant decrease in heart rate during the imitative situation (a 4 bpm decrease in baseline-situation heartrate) and mothers of preterm infants showed a significant elevation of heart rate during the spontaneous situation (a 5 bpm elevation in baseline-situation heartrate).

Comparison between neonatal and 3-month looking behaviors

A stepwise multiple regression was performed to determine the relative contributions of prematurity (gestational age) and neonatal inattentiveness to animate stimuli (examiner's voice and face on Brazelton assessment) in explaining the outcome variance of the 2 groups on their looking scores during the spontaneous mother face situation at 3-months. Although both these factors, prematurity and neonatal inattentiveness on the Brazelton, made significant contributions to the outcome variance ($R=.54$, $p < .05$), the Brazelton neonatal score entered the regression first as the more significant predictor.

Discussion

The findings which emerged from this study were: 1. infants looked at the dolls' faces more than at the mothers' faces and at the inanimate more than the animated faces; 2. the term infants looked at the spontaneous mother's face more than preterm infants did (particularly more than the male preterm infants); 3. the ratios for looking/looking away sequences increased from mother's spontaneous and imitative to doll's active and inactive faces; 4. the ratio for looking/looking away sequences was greater for the term than the preterm infant during the spontaneous mother's face situation; 5. infant heart rate was elevated for both term and preterm infants (although more highly elevated for preterm infants) during the spontaneous mother's face and significantly lower during the inactive doll's face situation for both groups. Heart rate did not change significantly during the imitative mother's face or the active doll's face situations; 6. mothers were more active during the spontaneous than the imitative face situation; 7. mothers of preterm infants showed elevated heart rate during the mother's spontaneous face situation and mothers of term infants showed lower heart rate during the mother's imitative face

situation; and 8. the inferior Brazelton scores on attentiveness to the examiner's animate face at birth appeared to be a more significant predictor than prematurity (gestational age) of the differences between these groups on attentiveness to mothers animated face at 3 months.

That total looking time and ratios of looking/looking away sequences were lower for the spontaneous mother situation in both groups (although lower for the preterm group) suggests parallels in these measures of looking. That heart rate was elevated (and elevated to a greater degree for the preterm infant) suggests parallels in behavioral-cardiac activity, i.e., a parallel between elevated heart rate and inattentiveness. The finding that elevated heart rate accompanied lesser degrees of looking provides suggestive evidence that arousal levels may have been higher or information processing demands greater, and infants may have been looking away for longer periods during the mother's spontaneous face situation to modulate arousal levels and process information. Support for greater information processing and arousal modulation demands being placed on the infants in this situation derives from the finding that mothers were more active in this situation than in the imitative situation. The mothers of preterm infants (who were less attentive as a group) were more active and showed correspondingly greater elevations in heart rate. This may relate to their higher activity levels or to the aversiveness of the lesser attentiveness of their infants. They accordingly engaged in what seemed to be counterproductive activity of trying harder (or being more active) to elicit their infants' attentiveness. Similar findings on the variability of mothers' activity levels and infant attentiveness during spontaneous interactions (Brazelton et al, 1974; Field,

1977) and corresponding changes in heart rate levels of mothers and infants (Field, 1978) support the data on the spontaneous mother's face situation of this study.

During the mothers' imitative face situation mothers were less active and infants more attentive. Heart rate levels were no longer elevated for infants or mothers. The lower levels of heart rate for the mothers may have reflected increasing attentiveness to the infants' gaze signals and behaviors in order to imitate them. The lesser activity of the imitative mothers and the greater attentiveness and approximately baseline levels of heart rate for the infants suggests that mothers' imitations of infants' simpler behaviors may have more closely approximated the infants capabilities of information processing and arousal modulation. By virtue of their being lesser amounts of stimulation (smiling, grimacing, talking and laughing) to process, or fewer of these arousing behaviors, the infants may have been less aroused and thus experienced less need to look away. Although there is no direct evidence that high arousal leads to gaze aversion in this study, those situations of elevated heart rate were characterized by longer periods and total durations of looking away, and elevated heart rate and looking away have been associated with arousing face-to-face situations (Ellsworth & Ludwig, 1972; Exline, 1961). A more direct test of the coordination of looking away and elevated heart rate would be an assessment of phasic heart rate in this situation, although the behaviors are emitted with such rapidity that heart rate hasn't sufficient time to return to baseline for a stimulus-locked analysis of heart rate.

Further support for the interpretation that more animation or stimulation contributes to more looking away and elevated heart rate comes from

the inanimate stimulus (the doll) situations. The infants' total durations of looking and ratios of looking/looking away sequences were higher for these situations, particularly the inactive doll situation. Correspondingly, heart rate was significantly lower (a concomitant of greater attentiveness and/or lesser arousal) during the inactive doll situation for both groups.

A stimulus novely interpretation for greater attentiveness to the dolls' than mothers' faces is unlikely since 1. the popular raggedy ann doll was already owned by most of these infants, and thus relatively familiar; 2. the stimulus configuration of a mother 's animate face is constantly changing, and thus relatively novel; and 3. the infants accorded the inanimate doll's face more looking time than the same but animated doll's face, although one could argue that the movement and voice of the animated raggedy ann doll made it the more absolutely novel stimulus.

An alternative interpretation relates to the differences in gaze alternation behavior observed in the presence of the faces. In all of these situations the infants alternately looked at and looked away from the faces, but periods of looking at the doll's inanimate face were longer than periods of looking at the mother's animate face and periods of looking away shorter.

This gaze alternation behavior is in contrast to the more sustained, uninterrupted fixations reported for blinking lights (Carpenter, 1974), an inanimate monkey (Brazelton, Koslowski & Main, 1974), and assorted toys (Fischer, 1973). Gaze alternation or on/off looking behavior in the presence of both animate and inanimate faces has been noted by several investigators (Brazelton et al, 1974; Carpenter, 1974; Stern, 1974;

Field, 1977). Although gaze alternation or on/off looking behavior is intrinsic to the visual system, the ratios of looking at/looking away seem to relate to the dimensions of the stimulus, in this case, the type of face and degree of animation.

The above investigators have suggested that gaze alternation serves to modulate the amount of stimulation received or maintain visual input at a level commensurate with optimal arousal and with the ability to process the visual information. Periods of looking away are thought to be as integral to the processing of information as are the periods of looking. The periods of looking away in these studies were not characterized by passive disinterest in the stimulus or active search for other stimulation. Rather, they featured expressions of concentration, as if looks away were pauses or time-outs to process the information received during the previous looking period. A similar interpretation has been made for the long periods of looking away by an adult speaker as he processes the feedback from his listener and organizes his train of thought (Kendon, 1970). Others have suggested that because eye contact increases cortical stimulation (in monkeys, Wada, 1961) and is arousing (in humans, Ellsworth & Ludwig, 1972), the looking away periods serve to modulate arousal level. That infants' levels of tonic heart rate were higher during the mother's animated face situation and lower during the inanimate doll's situation and higher in the mothers than the dolls animated face situations, suggests that there was more arousal associated with greater degrees of animation. Paralleling higher tonic heart rate in these situations were lower looking/looking away ratios and lesser looking time suggesting that more time spent looking away may have related to higher arousal reflected by higher tonic levels of heart rate.

Infants might be expected to look at their mothers' faces for shorter periods than at a doll's face and look away for longer periods, since the mother's face seemingly contains more stimulation to be modulated and more information to be processed.

Further support for this notion derives from the following findings of other studies: 1. in the presence of mothers engaging in "infantized" imitative behaviors as opposed to adult-like behaviors, infants' attentive periods were longer (Field, 1977); Trevarthen, 1977). In the present study infants looked longer at the dolls' faces than at the imitative mother's face, but the difference was less dramatic than the dolls' faces versus the spontaneous mother's face; 2. in the presence of mothers exhibiting slowed-down behaviors, infants were more attentive (Tronick, Adamson, Wise, Als & Brazelton, Note 1); and 3. with increasing age, and presumably advancing information processing and arousal modulation abilities, term infants looked at their mothers' faces for longer periods (Carpenter, 1974), as did preterm infants (Masi, 1977). In these situations the simpler the mothers' behaviors, or the less information they contained, the longer the infants looked at their mothers' faces. The periods of longer looking at a manikin's face (Carpenter, 1974) or a raggedy ann doll's face might be explained by the inanimate object containing less stimulation to be modulated or less information to be processed.

An extension of this interpretation to the finding of shorter fixations of the mother's spontaneous face and higher tonic heart rate of preterm infants during that situation (particularly the preterm male infant) is somewhat disconcerting, since it implies lesser abilities to modulate stimulation or process information . The regression of this study suggested that the Brazelton orienting score was a more efficient

predictor than gestational age, implying some continuity between attentiveness to animate stimulation at birth and 3 months.

The mother's face contains stimulus properties typically described as attention-getting, i.e., "faceness", motion and relative novelty which would predictably elicit longer fixations. Shorter fixations of the mothers' than the dolls' faces illustrates the complexity of attention getting/attention maintaining phenomena. Although an information processing/arousal modulation interpretation of gaze alternation or looking/looking away behavior requires further investigation, the results of this study support the notion that gaze alternation varies with the dimensions of the stimuli, e.g., the degree of animation, and type of face (mother's or doll's) in this study, and that pauses or periods of looking away are as critical as visual fixations in the perceptual, arousal, information processing phenomena underlying visual attentiveness.

Reference Notes

1. Tronick, E., Adamson, L., Wise, S., Als, H., & Brazelton, T.B. Mother-infant face-to-face interaction. Manuscript submitted for publication, 1976.

References

Brazelton, T.B. Neonatal behavioral assessment scale. Philadelphia: J.B. Lippincott Co., 1973.

Brazelton, T.B., Koslowski, B., & Main, M. The origins of reciprocity: The early mother-infant interaction. In M. Lewis and L. Rosenblum (Eds.), The effect of the infant on its caregiver. New York: Wiley, 1974.

Carpenter, G.C. Visual regard of moving and stationary faces in early infancy. Merrill-Palmer Quarterly, 1974, 20, 181-194.

Carpenter, G.C., Tecce, J.J., Stechler, G. & Friedman, S. Differential visual behavior to human and humanoid faces in early infancy. Merrill-Palmer Quarterly, 1970, 16, 91-108.

Ellsworth, P., & Ludwig, L.M. Visual behavior in social interaction. Journal of Communication, 1972, 22, 375-403.

Field, T. Effects of early separation, interactive deficits and experimental manipulations on infant-mother face-to-face interaction. Child Development, 1977, 48, 763-771.

Field, T. Interaction patterns of preterm and term infants. In T. Field et al (Eds.), Infants born at risk. New York: Spectrum Publications, in press, 1978.

Fischer, K. Rhythms of infant play. Unpublished master's thesis, Tufts University, 1973.

Kendon, A. Some functions of gaze direction in social interaction. Acta Psychologica, 1967, 26, 22-63.

Masi, W.S. A comparative study of social responsiveness in premature and full-term infants. Dissertation, Nova University, 1977.

Miranda, S.B. Visual abilities and pattern preferences of infants. Journal of Experimental Child Psychology, 1970, 10, 189-205.

Peary, J.C., & Stern, D.N. Mother-infant gazing during play, bottle feeding, and spoon feeding. The Journal of Psychology, 1975, 91, 207-213.

Stern, D.N. Mother and infant at play. In M. Lewis and L. Rosenblum (Eds.), The effect of the infant on its caregiver. New York: Wiley, 1974.

Trevarthen, C. Conversations with a 2-month-old. New Scientist, 1974, 22, 230-235.

Wada, J. Modification of cortically induced responses in brain stem by shift of attention in monkeys. Science, 1961, 33, 41-42.

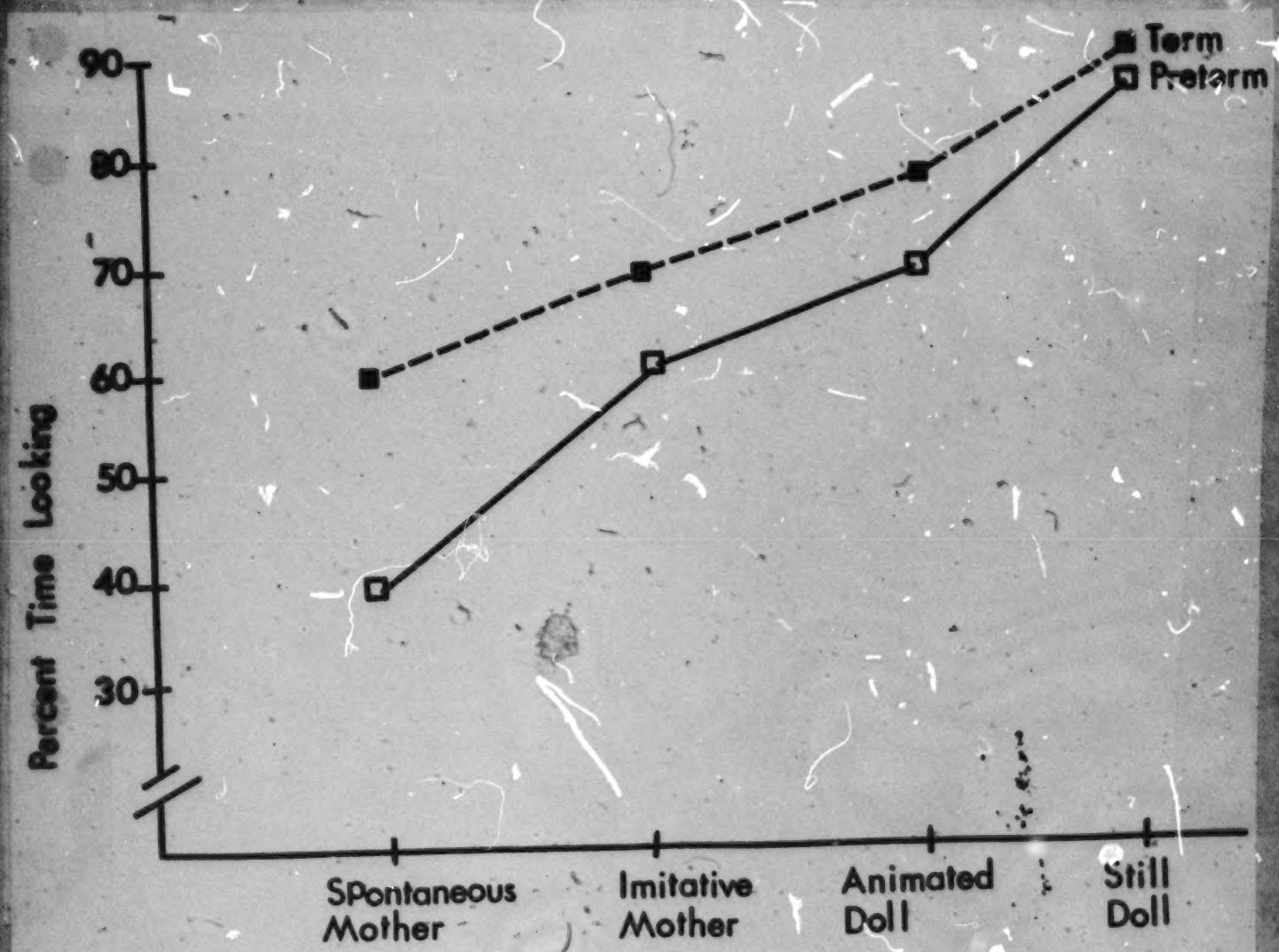
Footnote

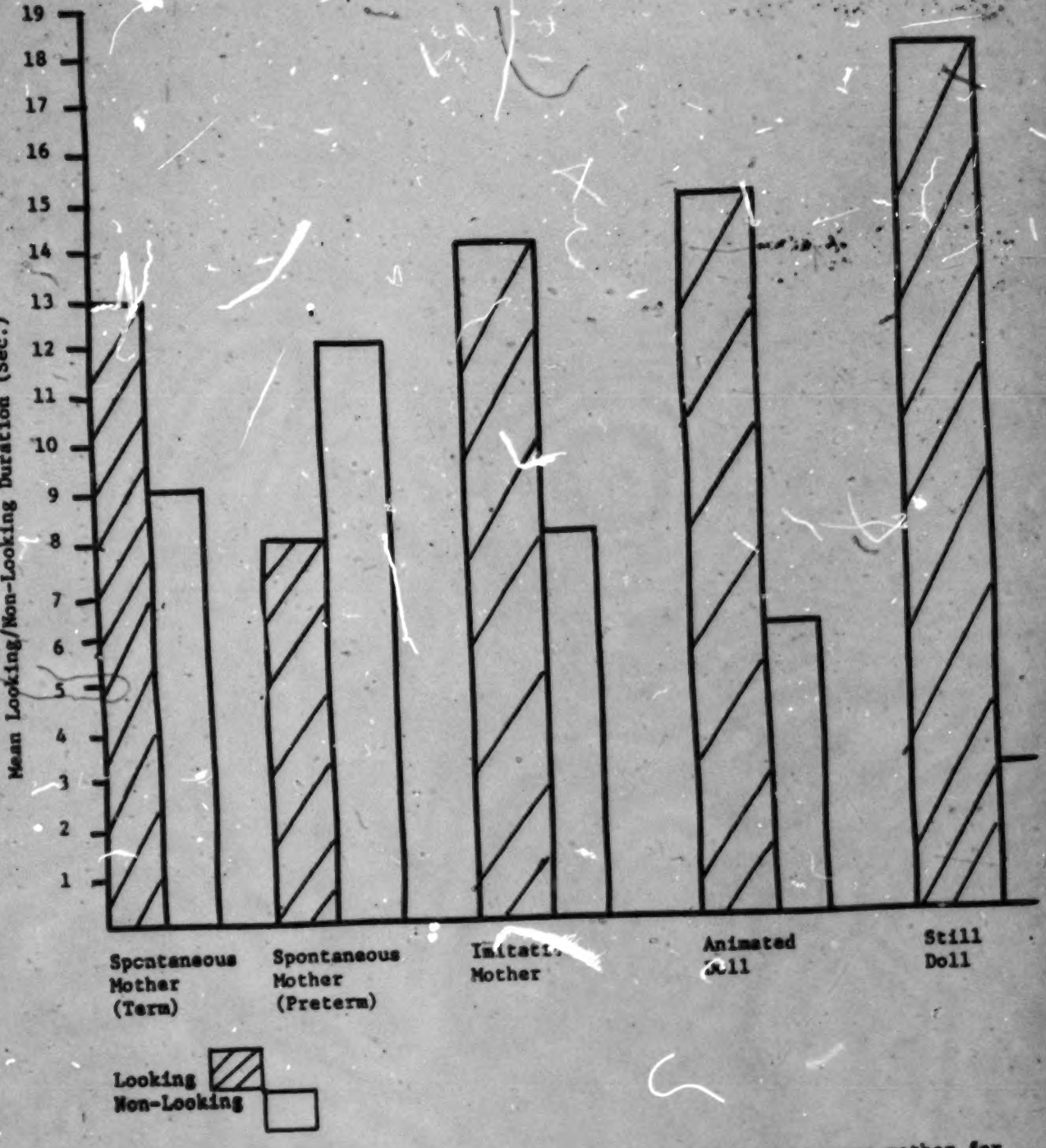
An abridged version of this paper was presented at the Southeastern Conference on Human Development, Atlanta, April 1978.

Special thanks go to the infants and mothers who participated in this study. Reprints may be obtained from Tiffany Field, Mailman Center for Child Development, University of Miami, P.O. Box 520006, Miami, Florida 33152.

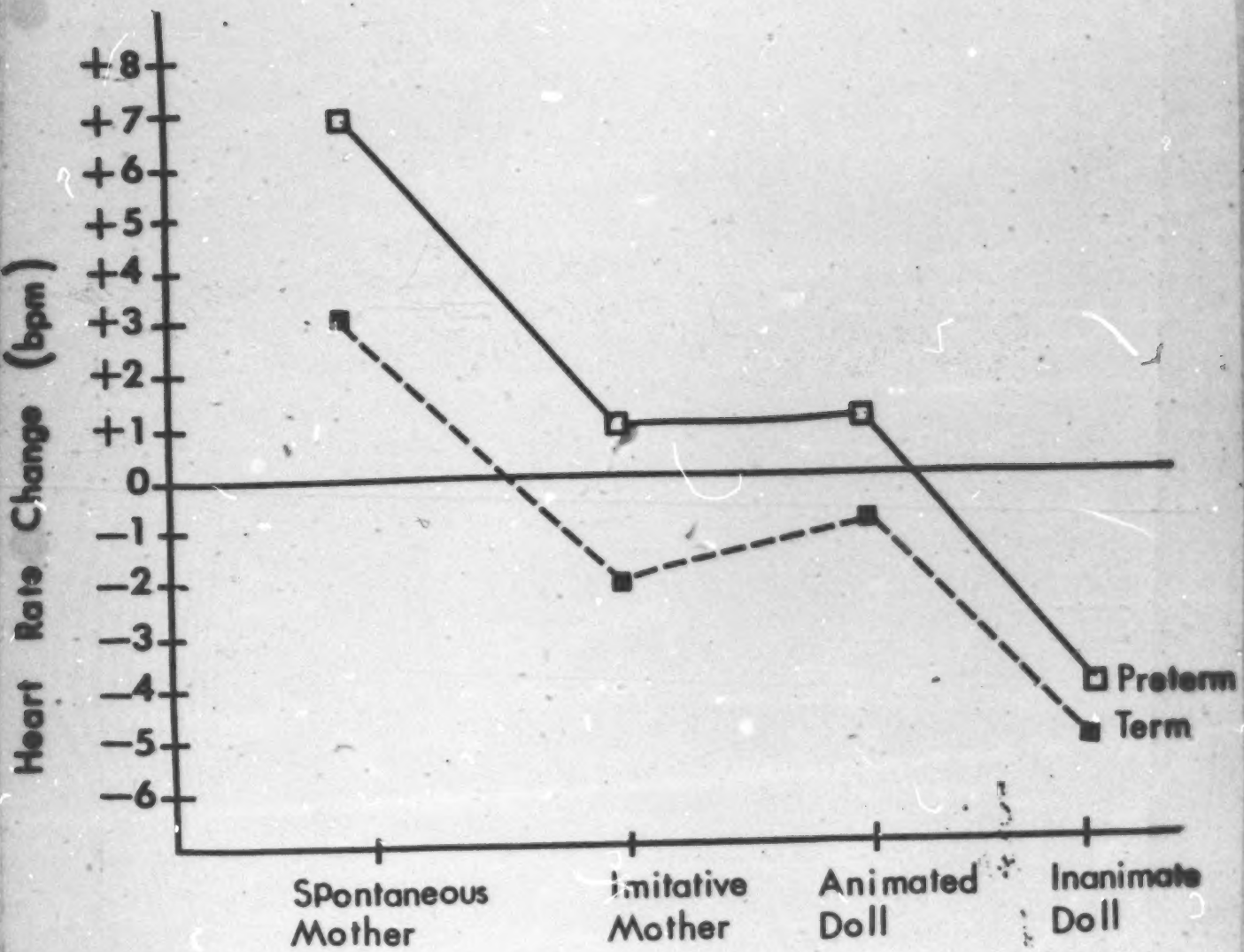
Figure Captions

1. Percent of time that term and preterm infants engaged in looking during the various face situations.
2. Infants' mean looking/non-looking durations (secs.) during the various face situations.
3. Term and preterm infants' mean heart rate change (bpm) from baseline activity to the various face situations.


Term
Preterm
Percent Time Looking
90
80
70
60
50
40
30
SPontaneous Mother
Imitative Mother
Animated Doll
Still Doll



Note: Groups are collapsed for all situations except spontaneous mother for which group differences were significant


Heart Rate Change (bpm)
+8
+7
+6
+5
+4
+3
+2
+1
0
−1
−2
−3
−4
−5
−6
Preterm
Term
SPontaneous Mother
Imitative Mother
Animated Doll
Inanimate Doll